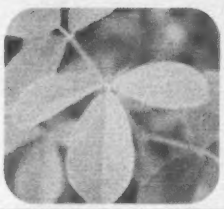

CROP TALK

Volume 15, Issue 1 OMAFRA Field Crop Specialists — Your Crop Info Source March, 2015

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A New and Improved Soil Nitrate Test For Corn!

Greg Stewart, Corn Specialist, OMAFRA and K. Janovicek, University of Guelph

What's New?

Measuring the amount of nitrate-nitrogen in the surface 30 cm (12.in.), usually in the first two weeks of June, has proven to be a reasonably good indicator of potential soil nitrogen (N) supply for a corn crop. This test is commonly referred to as the Pre-Sidedress Nitrogen Test or PSNT and was first introduced into Ontario in 1993.

Over the last twenty years we have examined the PSNT nitrogen fertilizer recommendations for corn and now, in 2015, we have arrived at a superior recommendation approach using this test. This new approach or calibration will be significantly more accurate than the older recommendation, especially in higher yielding corn fields.

What's Different?

The main difference in the new PSNT recommendation system is that sidedress fertilizer N rates will hinge not solely on the soil nitrate value (i.e. 15 PPM) but will also factor in the expected yield for the field or part of the field. In the former PSNT approach this was always a concern and some of you have called over the years to express this concern. How could a 15 PPM soil nitrate test mean the same amount of recommended nitrogen regardless of whether it came from a field where the yield expectation was 135 bu/ acre or from a field that was going to yield 235 bu/acre? Thanks for those calls; they inspired us to keep working at improving the PSNT.

Cropline 1-888-449-0937

Ministry of Agriculture, Food and Rural Affairs

Ontario

So now Table 1 illustrates the new recommendations for sidedress N application rates based on both the soil N test and yield expectations.

What's Not Different?

The actual testing procedure has not changed just the recommendation system. So all of the old rules still apply:

1. Samples must be from a depth 30 cm (12 in.).
2. It is important that all cores in a field be taken to the same depth.
3. It is very important to ensure that sampling avoids any previously broadcast nitrogen fertilizer or starter fertilizer bands.
4. Sampling should occur when corn is 6-12 inches (15 – 30 cm) tall, usually in the May 25 – June 15 window.
5. Soil nitrate samples tend to be less accurate when sampled after periods of significant rainfall. If possible allow a day or two for the soil to dry before taking PSNT samples.
6. Place soil cores in a clean plastic pail, crushed by hand and well mixed.
7. Microbial action in the sample can change the nitrate content quickly if it is not handled properly. Chill or freeze samples as soon as possible. For shipping, pack samples with insulating material to keep them cool and send them by courier to ensure quick delivery to the lab.

Other Considerations

Spilt applications of nitrogen are generally considered to offer environmental and profitability advantages over approaches where all the N is applied at planting. However, we are convinced that the real advantage to split applications comes when sidedress rate fine-tuning is accomplished. Measurement of soil nitrate-nitrogen concentrations is one tool for accomplishing this. Our research to date suggests that properly conducted PSNT testing combined with this new recommendation schedule can result in N recommendation improvements compared to the general N recommendations derived from the N Calculator.

The other exciting option that now exists with this tool is the potential for site specific variable rate N applications. A field that is divided into yield zones could then be PSNT sampled by those zones, a yield expectation applied to each zone, and then a variable rate prescription derived from Table 1. Something great to try in 2015!

Table 1. Pre-Sidedress Nitrogen Soil Test (PSNT) fertilizer N recommendations based on soil nitrate concentration (PPM) and expected yield (bu/acre).

Soil Nitrate (PPM)	Expected Yield (bu/ac)					
	120	143	167	191	215	239
	Sidedress Nitrogen Fertilizer Recommendation (lb N/acre)					
0	176	197	218	240	261	282
2.5	163	184	205	225	246	267
5	151	171	191	211	231	252
7.5	138	158	177	197	216	236
10	126	144	163	182	201	221
12.5	113	131	149	168	187	206
15	99	117	135	153	172	190
17.5	83	102	120	138	156	175
20	57	86	105	123	141	159
22.5	0	60	88	107	126	144
25	0	0	63	90	110	128
27.5	0	0	0	66	92	111
30	0	0	0	0	68	93
32.5	0	0	0	0	0	69
35	0	0	0	0	0	0

Permit—Guidelines For Use In Field Corn

Mike Cowbrough, Weed Specialist, OMAFRA

The 2014 registration of Permit (active ingredient: halosulfuron) in Ontario provides a nice tool for the management of yellow nutsedge in corn. Permit will also provide residual control of certain broadleaf weeds. For those two reasons, many growers will consider tank-mixing glyphosate and Permit for use in glyphosate tolerant corn. Here are 5 key points to consider when using this tank-mix.

1) **When do I apply Permit?**

When tank-mixed with glyphosate, it can be applied up to the 8-leaf stage of corn. (Permit can be applied on its own up to the 10-12 leaf stage of corn). Since Permit will often be tank-mixed to improve yellow nutsedge control, application timing should target yellow nutsedge when it is 8 to 30 cm (3-12") tall.

2) **What rate of Permit should be used for yellow nutsedge?**

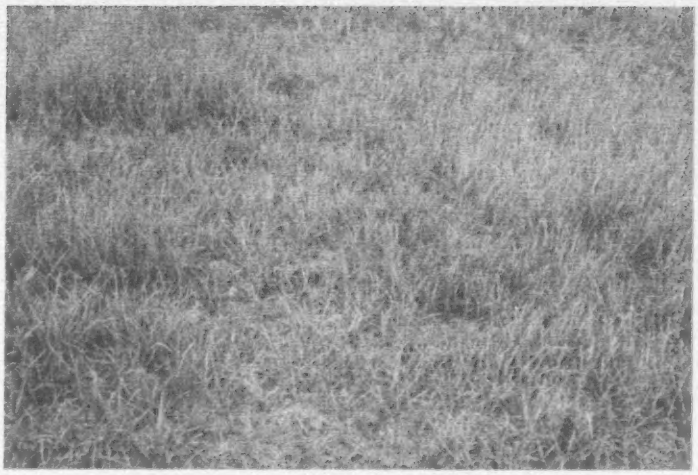
The label provides two rate ranges depending on the size of yellow nutsedge.

- Nutsedge that is 8-15 cm (3-6") tall: 35 – 47 g/ha (14-19 g/ac)
- Nutsedge that is 8-31 cm (3-12") tall: 70 – 93 g/ha (28 – 37.7 g/ac)

When control of yellow nutsedge was evaluated at the Elora Research Station, the 47 g/ha (19 g/ac) rate provided very effective control More recently, Dr. Peter Sikkema has evaluated yellow nutsedge control at different rates and more consistent control was achieved at the highest labeled rate. I believe that different field populations of yellow nutsedge vary in their susceptibility to herbicides and therefore you will see a range in their level of control. Ultimately, you may choose to experiment with Permit rates on your farm to come up with a rate that works best. Ideally, you start with the highest rate and scale back the rate depending on the level of control achieved. Lastly, visual control of nutsedge top growth will occur slowly, so don't be surprised if the control is not impressive two or three weeks after application.

3) **Is an adjuvant required?**

The manufacturer (Gowan) is recommending that a non-ionic surfactant (i.e. Agral 90) be added at 0.25% v/v (2.5 L/1,000 L of water) even when tank-mixing with a glyphosate product.



Example: Visual control of yellow nutsedge at 2 weeks after an application of Permit (19 g/ac) + Agral 90 (0.25% v/v) (right) compared with the untreated control (left).

4) **Does Permit provide residual weed control?**

Yes, according to the label it will provide control of the following un-emerged species. (I have condensed the list to focus on species that are typically found in corn):

- pigweed species (not group 2 resistant biotypes)
- chickweed
- cocklebur
- hairy galinsoga
- Canada fleabane (not group 2 resistant biotypes)
- jimsonweed
- lady's-thumb
- lamb's-quarters
- flower-of-an-hour
- wild mustard
- yellow nutsedge (supression of un-emerged shoots)

5) **Do I need to worry about crop safety?**

2013 University of Guelph trials (Ridgetown campus) demonstrated acceptable levels of crop safety with a glyphosate + Permit + 0.25% v/v tank-mix. However, since Permit is a sulfonylurea herbicide (in the same family as Accent, Option, Peak, Ultim etc.) the potential for crop injury may be increased when applications are made:

- during periods of large swings in air temperatures (i.e. going from a low of 7° C to a high of 30° C).
- to sensitive hybrids (historically, certain seed corn companies published this information, but I have been unsuccessful in finding any specific guidelines, so ask your seed supplier).
- during very hot and humid conditions (above 28° C)
- if a soil or foliar applied organophosphate insecticide has been used (an unlikely scenario).

White Mould In Soybeans

Albert Tenuta, Field Crops Pathologist, OMAFRA

There was a lot of white mould in the Ontario soybean crop in 2014. Conditions that favour white mould growth and what can be done to reduce it is summarized below.

Factors Favoring White Mould

1. High yield potential crop / field
2. Field history of white mould
3. Susceptible variety
4. Short soybean rotation
5. Dense canopy - High plant population, narrow rows and early planting
6. Poor weed control (hosts)
7. In- season weather conditions – cool and moist are favourable for white mould

IPM for White Mould Management

- Keep good field records of disease levels
- Variety Selection
    - A. Best available level of tolerance
    - B. Appropriate maturity
    - C. Upright, non-bushy with good lodging tolerance
- Cultural practices such as:
    - a. Reduce plant populations and increase row width
    - b. Rotate with non-host crops (2 to 3 years non-host such as corn and wheat)
    - c. Reduce tillage but avoid soybeans on soybeans – high risk situation
- Fungicides – target fields at risk (above)
    - a. Many chemical / biological options
    - b. Proper timing and coverage critical –
        - i. First spray at R1 (first flower) with 2nd application at R3 (pod forming) if necessary

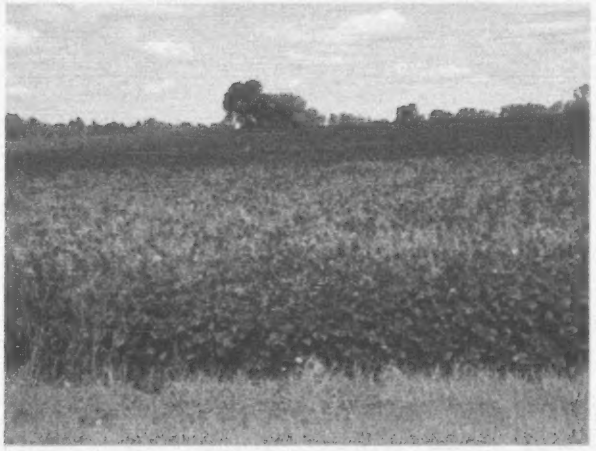


Figure 1. A soybean field in August showing significant white mould damage

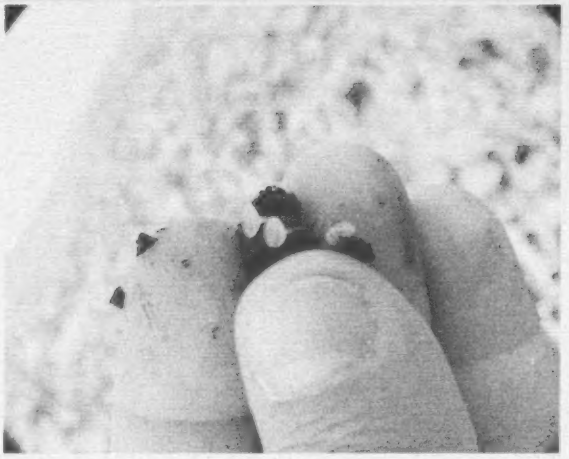


Figure 2. Apothecia: Sclerotia in the soil will produce mushroom-like structures called apothecia that eject spores onto the soybean plant

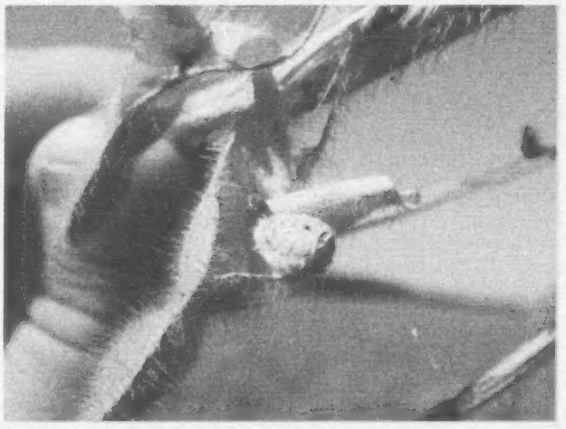


Figure 3. Sclerotia stem: after the spores inoculate the plant, the fungal pathogen grows and consumes plant nutrients which cause the stems to girdle, this kills any plant tissue above and results in injury as shown in Figure 1.

Figure 4. Selerotia pod: the black sclerotia, as seen here attached to a soybean seed within the pod, which when re-introduced to the soil will start its life cycle all over again.

Establishing A New Pasture

Jack Kyle, Pasture Specialist, OMAFRA

Reasons to establish a new pasture include moving from annual crops to perennial pasture or forage, or to improve an existing pasture that is not producing very well. When planning to seed new pastures there are a few questions that you should ask yourself before actually starting the process. An existing pasture that is not very productive may respond to the application of fertilizer, but the response will not be nearly as significant or long term as reseeding and getting productive species established in the field.

What is the intended purpose of the new seeding?

- Do you want early-season grazing or late-season grazing?
- Are you going to cut it for stored forage sometimes ?
- Is this pasture going to stay down for many years or is it part of a farm crop rotation plan and will be planted to another crop in less than 10 years?

Pasture Species

If you want late-season and stockpiled grazing to be the main use of this pasture, then trefoil and tall fescue should likely be your predominate species. If you want early season pasture, then clovers, alfalfa and orchard grass should form the basis of the mix. Alfalfa will do very well on well drained soils, while poorly drained soils are better to be seeded to clovers and trefoil.

Many people are overly cautious about including alfalfa in a pasture. With proper management, an alfalfa based pasture will give you the best animal performance along with the highest yields of quality forage. Alfalfa's deep roots and heat tolerance make it the obvious choice for mid - to late-summer grazing. With a good rotational grazing system and best management practices, it will be very successful.

There are a number of grass species that should be considered. My preference is for orchard grass because of its early spring growth, rapid regrowth, and once the seed head is removed it stays vegetative for the rest of the growing season. Meadow brome is also an excellent pasture species. Timothy is often found in mixes but it has poor summer re-growth. Other grass species that warrant consideration include ryegrass (especially for a short duration pasture), reed canary grass, festolium (cross between ryegrass and fescue) and possibly bluegrass (especially for a long term pasture). There is a good description of forage species in the OMAFRA Publication 811, Field Crop Agronomy Guide at http://www.omafra.gov.on.ca/english/crops/pub811/3species.htm

Soil Fertility

Soil fertility is a major consideration. The new seeding will not perform very well if the pH is too low, or if the phosphorous and or potassium levels are low. Pasture fertilizer rates based on soil tests are also in the Agronomy Guide. http://www.omafra.gov.on.ca/english/crops/pub811/3fertility.htm

Seeding

Forages can be no-tilled or planted into a tilled seed bed. The seed bed should be firm enough to allow for good depth control and seed-to-soil contact. Forage seeds are very small and should be planted 7-10 mm (1/4 – ½ in) deep. The use of a companion crop is optional. If using a companion crop, consider using oats harvested as haylage or baleage at the boot to very early heading stage. This will eliminate the competition effect from the companion crop and allow the new seedling every opportunity to grow during July and August. The field should not be grazed until the forage plants are well rooted. Cattle tear the pasture plants off, and if they are not fully anchored in the soil they will be pulled out!

Planting the appropriate species into a reasonably fertile seed bed should give you a productive pasture for many years.

Making the Most of Your On-Farm Trials

Gilles Quesnel, Field Crop Integrated Management Specialist and Ian McDonald, Applied Research Co-ordinator, OMAFRA

A well-planned and run on-farm trial is a great way to test new ideas, products, and equipment. But, to provide meaningful information, even a simple on-farm trial takes time to plan and carry-out.

For an on-farm trial to provide useful information, two basic requirements need to be met. First, the trial has to be set up in a way that all the production variables (e.g. drainage, fertilizer, tillage, etc.) are kept constant across the plot, with the exception of the treatment (e.g. hybrids, fungicide, plant population, etc.) being tested. Second, to have confidence in the results generated, the trial has to be set up in a way that the data collected can be statistically analyzed. This is mostly code word for the need to replicate and randomize (arranged each treatment in a different order in each replication) the trial.

The following are guidelines for setting up on-farm trials:

Planning

Determine the objective of the trial and identify the information which will need to be collected (e.g. variety, planting date, yield, % residue cover, etc.). Without replicates, it is impossible to know if measured treatment differences are real or just due to random chance or error. Designing a simple plot with only 2 or 3 treatments (e.g. a foliar fungicide on corn compared to a non-treated check) will make it easier to replicate each treatment at least twice, but preferably 3 or 4 times in the field.

To be confident that there is sufficient data for real and defendable analysis of the results, a minimum of 6 plots is required for a trial, which can be a combination of treatments and replicates. Therefore, if you only compare 2 treatments, then you need 3 replicates (2 x 3 = 6). The exception to the 6 plot minimum would be for some of the corn hybrid plots, like the ones done by the seed industry, where each location is used as a replicate, with the same hybrids entered at multiple locations. This will provides sufficient location replications for proper data analysis.

Actual block widths should be based on the width of the equipment used (planter, sprayer, combine header, etc.). Each treatment plot (strip) should be at least 500 feet long and large enough to yield at least 1,000 lbs of harvested crop to minimize the impact of inherent measurement and weighing errors. When comparing inputs such as fertilizer rates, the rate difference between treatments needs to be large enough to produce a measurable impact on yield (e.g. a difference of at least 30 lbs/acre of actual nitrogen for corn).

Field Selection

Ideally, the field should be uniform in slope, drainage, and fertility, and of a soil type that is representative of your farm. If the field has a slope, orient the plot so the treatments run vertically up and down the slope. Locate plots at least 100 feet away from fence rows and up to 200 feet away from large trees. When possible, the trial should be planted perpendicular (90° angle) to known sources of potential variables such as tile lines, primary tillage or dead furrows and field operations (e.g. fertilizer, manure application). This reduces the potential for added variability that may be associated with overlaps or misses of crop inputs.

The goal is to reduce inherent or applied variation in the whole plot to ensure observed treatment differences are real and not due to unrelated underlying variations. It is critical to observe the field over the course of the season. Be prepared to use your best judgement as to whether there are things happening in the field that could impact the results that weren't associated with treatment differences. You have to be prepared to abandon the plot results if it is obvious that there is something wrong with the overall project site.

Plot Layout

Design the plot on paper or electronically, including replication and randomization positions, ensuring that sufficient field space is available for the trial. Ensure that treatments are well marked, which will make treatment position obvious throughout the season.

Figure 1 is an example of a replicated (3 replications and randomized) plot for 3 treatments.

Rep 1	Plot 1	Treatment 1
	Plot 2	Treatment 2
	Plot 3	Treatment 3
Rep 2	Plot 4	Treatment 2
	Plot 5	Treatment 3
	Plot 6	Treatment 1
Rep 3	Plot 7	Treatment 3
	Plot 8	Treatment 1
	Plot 9	Treatment 2

Figure 1 . Plot Replication (3 treatments X 3 replications)

Figure 2 is a block layout option for a plot with 2 treatments and 4 replications. This layout works well when using wide equipment such as a 100 ft boom sprayer (e.g. foliar fungicide application).

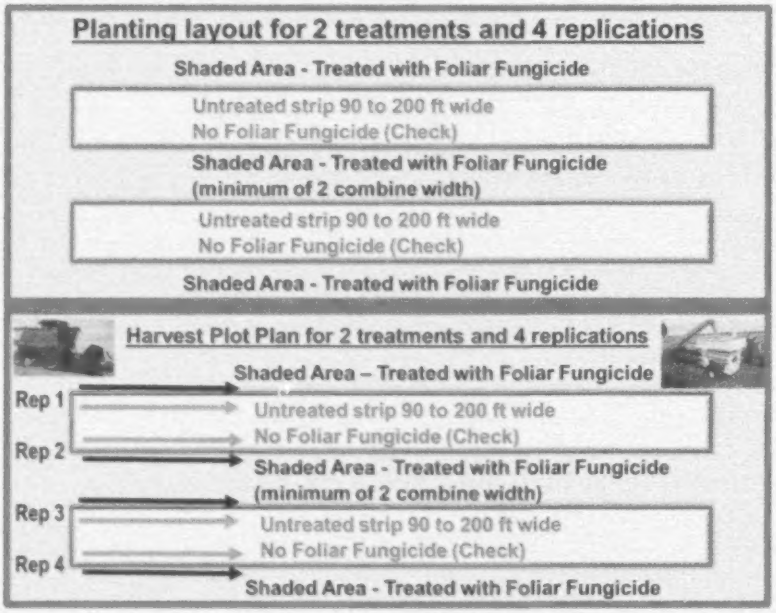

Planting layout for 2 treatments and 4 replications
Shaded Area - Treated with Foliar Fungicide
Untreated strip 90 to 200 ft wide
No Foliar Fungicide (Check)
Shaded Area - Treated with Foliar Fungicide
(minimum of 2 combine width)
Untreated strip 90 to 200 ft wide
No Foliar Fungicide (Check)
Shaded Area - Treated with Foliar Fungicide
Harvest Plot Plan for 2 treatments and 4 replications
Shaded Area – Treated with Foliar Fungicide
Rep 1
Rep 2
Untreated strip 90 to 200 ft wide
No Foliar Fungicide (Check)
Shaded Area - Treated with Foliar Fungicide
(minimum of 2 combine width)
Rep 3
Rep 4
Untreated strip 90 to 200 ft wide
No Foliar Fungicide (Check)
Shaded Area - Treated with Foliar Fungicide

Figure 2 . Block layout option for a plot with 2 treatments and 4 replications

In figure 2, a strip is harvested and weighed from each of the side-by-side treatments (e.g. with and without fungicide on both sides of the block), for a total of 8 data points.

Harvest
Weigh wagons are more accurate than yield monitors to collect harvest weights. If using a yield monitor, the monitor should be calibrated and all the plots should be combined in the same direction and at the same speed to reduce error.

Making Use of the Data
Individual farm data is more valuable when combined with plot results from other sites. If you take the time to plan, plant and harvest a plot, make the time to analyse and share your results. Compile the data in a readable format and send it for analysis and aggregation to you Soil & Crop Director, OMAFRA specialist or Agribusiness representative as soon as possible after harvest.

On-farm trials can answer important questions, but requires significant planning and lots of attention to detail. Sound plot design plus statistical analyses can isolate background "noise" to help detect true treatment effects and improve your success in answering questions.

Bacterial Blight In Dry Beans Goes Airborne

Brian Hall, Edible Bean & Canola Specialist, OMAFRA

With the late start to planting, wet weather and late harvest, 2014 was a year many farmers are glad to have behind them. Despite this, many edible bean growers ended the season with good to excellent yields, but an increase in bacterial disease. Bacterial blights are worrisome when they strike as they typically can hurt both yields and seed quality.

There are three major bacterial blights of edible beans:

- common bacterial blight(CBB) ,
- halo blight (HB), and
- bacterial brown spot (BBS).

The adzuki bean crop was especially hit hard in 2014 by a serious outbreak of bacterial brown spot. Infections were first noticed in late July when hot spots spread quickly as wet, high humidity, windy weather prevailed. The disease continued to spread in fields until drier mid-August. By then, widespread infections of leaves, stems, and pods had occurred that resulted in poor yields and quality.

CBB is the most commonly occurring blight in dry beans. This was the first time BBS has been found in any edible bean type in Ontario. Other bean types can host the disease, but adzuki beans appear to be especially susceptible. Some Ontario snap bean growers also reported damage from BBS in 2014.

Where Does Blight Come From?
Infected seed is the initial source of bacterial infection in an area. Infected bean residue and weather play an important role in its spread. Serious outbreaks of CBB and HB develop when contaminated seed is planted. BBS can become established through infected seed, but can also survive on healthy plants for a long time without causing disease symptoms when conditions are not favourable. Unlike CBB and HB, these 'resident' BBS are considered the main source of infection. Other 'resident' host plants for BBS include corn, soybeans, other dry bean types and hairy vetch. Thus, it is possible for BBS to exist in an area before an outbreak occurs.

How Is Bacterial Disease Spread?
Long distance dispersal can occur on storms. The bacteria are thought to be able to travel in the atmosphere up to 100 miles. Spread from host plants can also occur by people, equipment, animals, insects and rain splash. When infected seed is planted and emerges, bacteria ooze from leaf surface and spread through rain splashed onto other plants. A severe epidemic can occur from only a few infected planted seeds and spread in a field with favourable weather conditions. Bacteria multiply rapidly and can more than double in as little as 30 minutes. Bacteria enter plants through natural openings (stomata) and through wounds caused by hail, driving rains, wind damage, blowing soil injury, insects, or equipment injury. Hard, intense rain storms have been shown to be especially conducive to the spread and multiplication. Localized thunder cells can be the source of infection in one field but not another just a few kilometers away.

Once introduced into a plant, the bacteria easily spread systemically though the leaves, stem, pod and into seed. HB is favoured by rainfall, high humidity and moderate temperatures (18^0 - 22^0 C), while CBB and BBS thrive under high temperatures (28^0 - 32^0 C).

Symptoms
Symptoms of CBB and HB can appear very similar. Initial leaf symptoms of all 3 blights appear as small (3-5 mm), water soaked spots that later turn pale green and eventually brown. With CBB and HB, the lesions enlarge, with the center becoming dry and may be surrounded by a yellow margin. Leaves can become ragged. Pod lesions start as water soaked spots that enlarge, merge and form sunken reddish-brown blotches. Cankers can appear greasy as bacteria ooze, and later dry to form a crust.

Leaf lesions of BBS often don't appear water soaked, and are much smaller than CBB and HB. When the disease becomes systemic, tan and sunken lesions with reddish brown border develop on stems and petioles. Pods may appear bent or have water soaked lesions with a reddish brown margin.

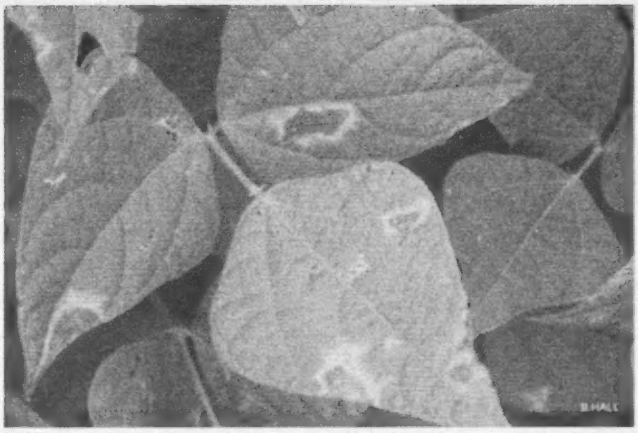


Figure 1 . Common Bacterial Blight (CBB) mature lesions

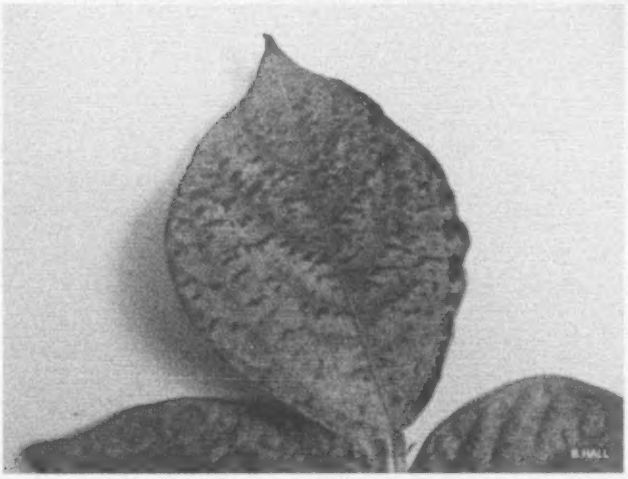


Figure 2. Bacterial Brown Spot (BBS) - Adzuki beans

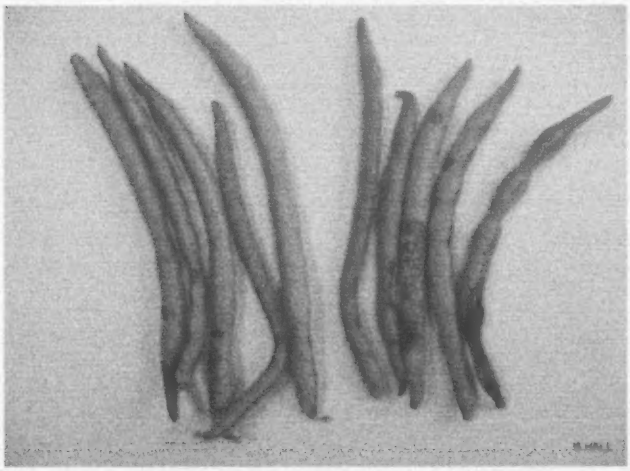


Figure 3. Bacterial Brown Spot (BBS) - Adzuki pod infection

How Effective Are Copper Bactericides?

Fungicides have no effect on bacteria blight diseases. Copper based bactericides can reduce growth of bacteria on foliage and limit spread to healthy foliage and pods. Applications are most successful when applied as an early preventative treatment during vegetative stage, because bacteria multiply and spread rapidly. Only poor to moderate control is achieved once an outbreak occurs because of the high level of bacteria inoculum usually already present in a field.

The first application should occur before symptoms appear and repeated every 7-10 days if conditions are favourable. Optimum application timing is following a rainstorm. In fields damaged by hail or violent storms, application of a bactericide can help protect plants if conditions are favourable for infection. Research has shown that copper bactericides are generally not as effective against CBB as BBS and HB.

What Else Can You Do?

1. Plant certified seed from a known source! Seed that has been grown in semi-arid regions (i.e. western grown) has very low risk of being infected.
2. Plant white beans resistant to CBB. White bean varieties are resistant to HB. Current white bean varieties with CBB resistance include OAC Rex, Lighthouse, Mist, Apex and Rexeter.
3. Streptomycin seed treatment will reduce or eliminate surface contamination, but it does not control infections in cracks or under surface of seed.
4. Do not grow beans (edible or soybeans) in the same field more than once every 3 years.
5. Tillage of infected residue will speed breakdown and reduce pathogen survival. Bacterial pathogens survive longer on bean residue left on the surface after harvest.
6. Sanitize cultivators, sprayers or other equipment between fields.
7. Stay out of fields while foliage is wet.
8. Avoid planting edible beans next to fields where beans were infected the previous year.
9. Closely check bean fields beginning at the mid-vegetative stage, especially during periods of high humidity. Infections following violent storms with strong winds, or hail often begin to become visible 7-10 days later.
10. Control volunteer adzuki beans.

Consider Seeding Red Clover In Spring Wheat

Scott Banks, Emerging Crop Specialist, OMAFRA

In recent research, red clover underseeded into spring wheat provided up to an extra $100/acre in grain corn yield the following year without reducing spring wheat yields!

A four year study (2009 – 2013) was initiated at the Winchester Research Station to look at the effect of underseeding red clover into spring wheat and its impact on the spring wheat yield as well as the corn yield the following year. The red clover was broadcast seeded at four different times:

1. At planting
2. At herbicide application (Zadok's 26-30)
3. Flag leaf emerged stage, (Zadok's 37-39) and
4. After wheat harvest.

Single-cut and double-cut red clover was broadcast into the spring wheat at 7 lbs/acre. Nitrogen was applied to all treatments at 90 lbs/ac in the spring wheat crop and at 100 lbs/ac in the corn crop the following year.

Results

Table 1 summarizes 3 year average corn yield for each of the previous year's red clover treatment. Based on a corn value of $4.50/ bushel, red cover added $33 - $100 per acre as compared to where no clover was underseeded in the spring wheat. As expected, red clover underseeded at earlier spring wheat stages (at planting or at herbicide application) rather than at flag-leaf or after harvest, provided more yield benefit to the following corn crop.

Due to the high yield variability the 2013 corn yield, it is not included in the above table.) Single cut red clover appears to have greater yield advantage in corn than double cut red clover, however the difference was only statistically significant in 1 of the 3 years.

Spring wheat growers are often reluctant to underseed red clover in spring wheat due to concerns that the red clover will compete and suppress the spring wheat grain yield. Table 2 summarizes the average spring wheat yield of each treatment.

Although the yield numbers showed that the inclusion of red clover slightly increased wheat yield, statistically there was no difference in yield of the spring wheat with or without red clover.

Summary

1. Underseed red clover in spring wheat.
2. The best time to seed red clover is with the spring wheat
3. Use either single cut or double cut red clover

Table 1: Average Corn Yield (2010, 2011 & 2012) following red clover underseeded in previous year at various spring wheat stages.

Treatments (Timing of Red Clover Seeding)	3 Year Average Yield (bu/ac)	Yield Difference from No Clover (bu/ac)	Additional Value of Red Clover Per acre with Corn @ $4.50 per bushel
No clover	144		
Single Cut - @ planting	167	23	$102.47
Double Cut - @ planting	163	18	$80.64
Single Cut - with herbicide	160	15	$68.96
Double Cut - with herbicide	157	12	$53.60
Single Cut - flag leaf emerged stage	161	17	$74.90
Double Cut - flag leaf emerged stage	152	7	$33.71
Single Cut - post-harvest	154	9	$39.81
Double Cut - post-harvest	157	12	$54.14

Table 2: Spring Wheat Average Yield (2009, 2010, 2011 & 2012) with red clover underseeded at various spring wheat stages.

Treatments (Timing of Red Clover Seeding)	Average Yield (bu/ac)	Yield Difference to No Clover (bu/ac)
No clover	53.9	
Single Cut - @ planting	58.4	4.5
Double Cut - @ planting	55.5	1.6
Single Cut - with herbicide	58.4	4.6
Double Cut - with Herbicide	57.7	3.8
Single Cut - flag leaf emerged stage	57.5	3.6
Double Cut - flag leaf emerged stage	57.5	3.6
Single Cut - post-harvest	59.4	5.5
Double Cut - post-harvest	58.1	4.2

Do Soybeans Require Insects For Pollination?

Horst Bohner, Soybean Specialist, OMAFRA

Soybeans are considered to be a self-pollinating legume. This means that pollen produced within a flower fertilizes the ovary of the same flower on the same plant. Therefore insects are not required to pollinate a soybean crop. Since soybean flowers do not readily attract insects like the flowers of other legumes, crosses in nature between two soybean plants are rare. Field experiments have shown that cross pollination is usually less than 1% in soybeans.

Soybean flowers are often fertilized by the time the flower opens and may occur a full day before the flower fully opens.[1] Some cultivars are entirely "cleistogamous", which means that the flower buds do not open at all and fertilization takes place with self-pollen. With some cultivars, flowers only open under the right environmental conditions. In a study of 12 soybean cultivars where both honey bees and indigenous insect populations were present, cross-pollination varied from as low as 0.09% to as high as 1.63% based on a two year average.[2] Therefore insects including honey bees are not required to pollinate soybeans and the presence of insects would not be expected to significantly improve yields.

Does A Lack of Fertilization Cause Flower Abscission?

The soybean plant produces many more flowers than will actually develop into pods. Over 80% of the flowers may abscise (fall away) producing no yield. There has been speculation that soybean flowers abscise because they have not been fertilized. However, failure of fertilization is not the cause for floral abscission since almost all abscised flowers are already fertilized and contain proembryos that have undergone two or three cell divisions.[3]

Do Insecticide Seed Treatments Result In Contaminated Soybean Pollen?

If pollinators do happen to feed on soybean flowers does the insecticide placed on the seed contaminate the pollen? Research conducted to evaluate the potential exposure of pollinators to neonicotinoid insecticides used to treat seed analyzed 560 samples from various crops for concentrations of clothianidin, imidacloprid, thiamethoxam, and their metabolites. They concluded that "there was no detection of neonicotinoid insecticides in flowers collected from four soybean tests where neonicotinoid seed treatments were being evaluated.[4]

Is There Research That Shows Bees Can Increase Soybean Yields?

Anecdotal evidence has been reported that the presence of honey bees may increase soybean yields under certain conditions. These reports are difficult to verify. There have been a few trials that showed increased yields under specific circumstances.[5] A recent study from Brazil purported yield increases of 18% from the introduction of honeybee colonies to a soybean field.[6] However, this trial was only conducted one year with limited replication, a small experimental area with a tropical soybean variety. The benefits of either cross- or self-pollination appear to be highly depend on cultivar, temperature, moisture, and the number of insects present. Studies that have shown yield increases from bees have often employed "caged" bees, forcing them to forage on soybeans or excluding them from the crop. These limited trials with unique research circumstances should not be considered representative of what may happen in an Ontario soybean field. No link between soybean yields and the presence of bees has been demonstrated under Ontario growing conditions. If bee hives are placed next to soybean fields it is important to communicate with the soybean grower. A foliar insecticide application to control soybean aphids or spider mites will cause harm to bees.

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